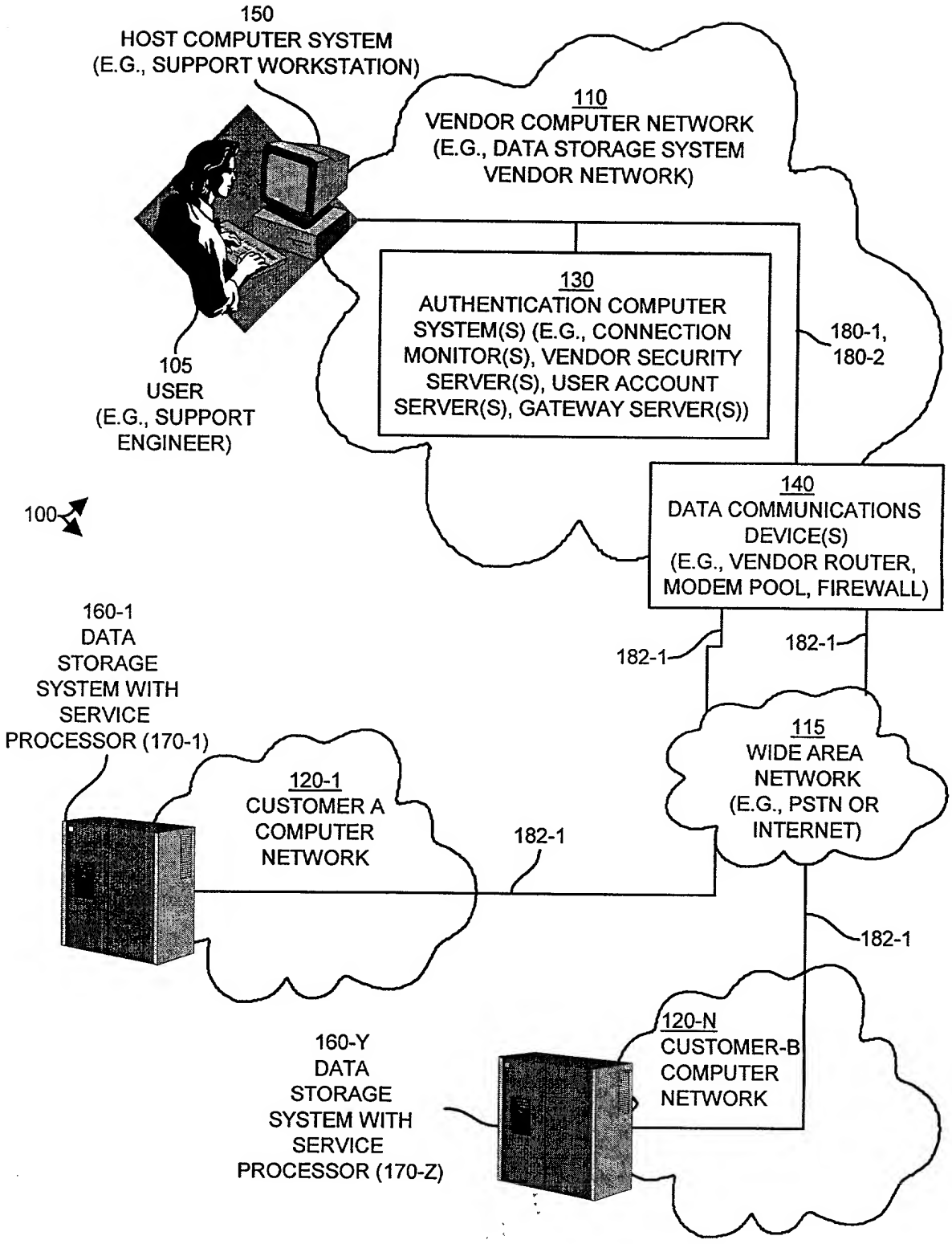
150
HOST COMPUTER SYSTEM
(E.G., SUPPORT WORKSTATION)
110
VENDOR COMPUTER NETWORK
(E.G., DATA STORAGE SYSTEM
VENDOR NETWORK)
130
AUTHENTICATION COMPUTER
SYSTEM(S) (E.G., CONNECTION
MONITOR(S), VENDOR SECURITY
SERVER(S), USER ACCOUNT
SERVER(S), GATEWAY SERVER(S))
180-1,
180-2
105
USER
(E.G., SUPPORT
ENGINEER)
100
140
DATA COMMUNICATIONS
DEVICE(S)
(E.G., VENDOR ROUTER,
MODEM POOL, FIREWALL)
160-1
DATA
STORAGE
SYSTEM WITH
SERVICE
PROCESSOR (170-1)
182-1
182-1
115
WIDE AREA
NETWORK
(E.G., PSTN OR
INTERNET)
120-1
CUSTOMER A
COMPUTER
NETWORK
182-1
182-1
120-N
CUSTOMER-B
COMPUTER
NETWORK
160-Y
DATA
STORAGE
SYSTEM WITH
SERVICE
PROCESSOR (170-Z)

FIG. 1

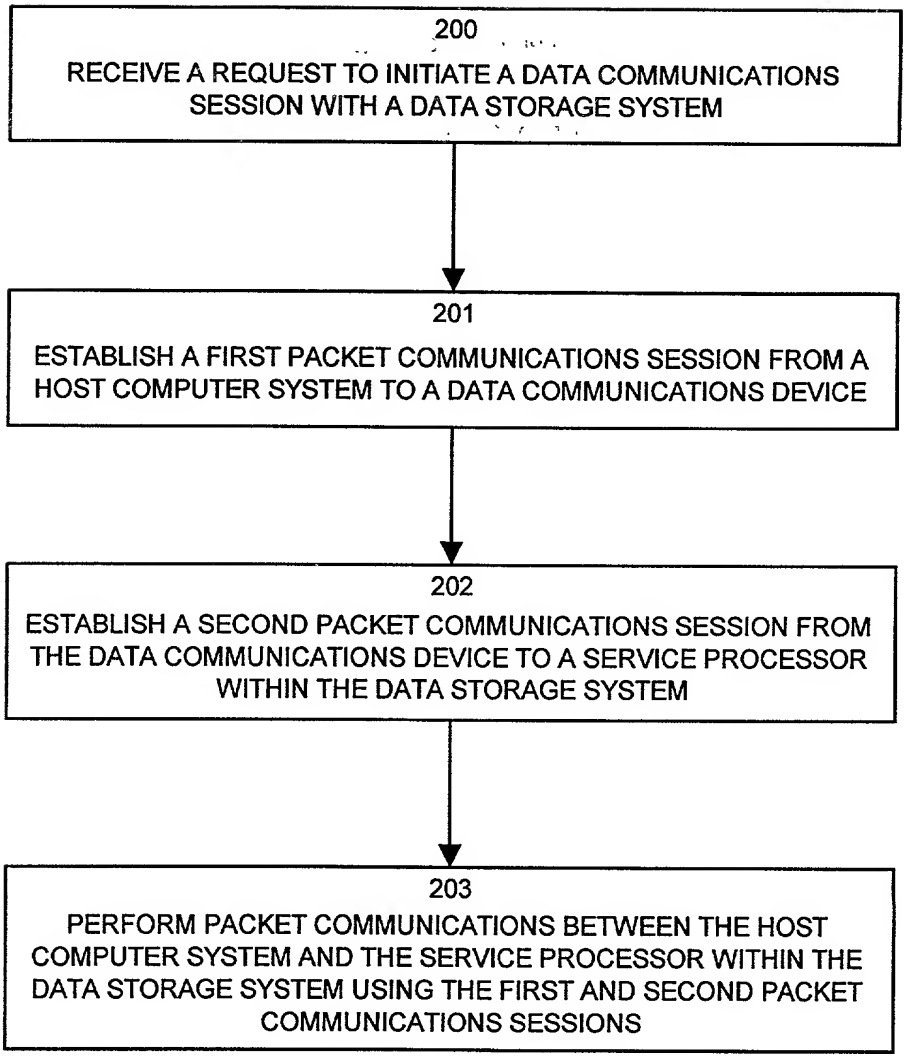
200
RECEIVE A REQUEST TO INITIATE A DATA COMMUNICATIONS SESSION WITH A DATA STORAGE SYSTEM
201
ESTABLISH A FIRST PACKET COMMUNICATIONS SESSION FROM A HOST COMPUTER SYSTEM TO A DATA COMMUNICATIONS DEVICE
202
ESTABLISH A SECOND PACKET COMMUNICATIONS SESSION FROM THE DATA COMMUNICATIONS DEVICE TO A SERVICE PROCESSOR WITHIN THE DATA STORAGE SYSTEM
203
PERFORM PACKET COMMUNICATIONS BETWEEN THE HOST COMPUTER SYSTEM AND THE SERVICE PROCESSOR WITHIN THE DATA STORAGE SYSTEM USING THE FIRST AND SECOND PACKET COMMUNICATIONS SESSIONS

FIG. 2

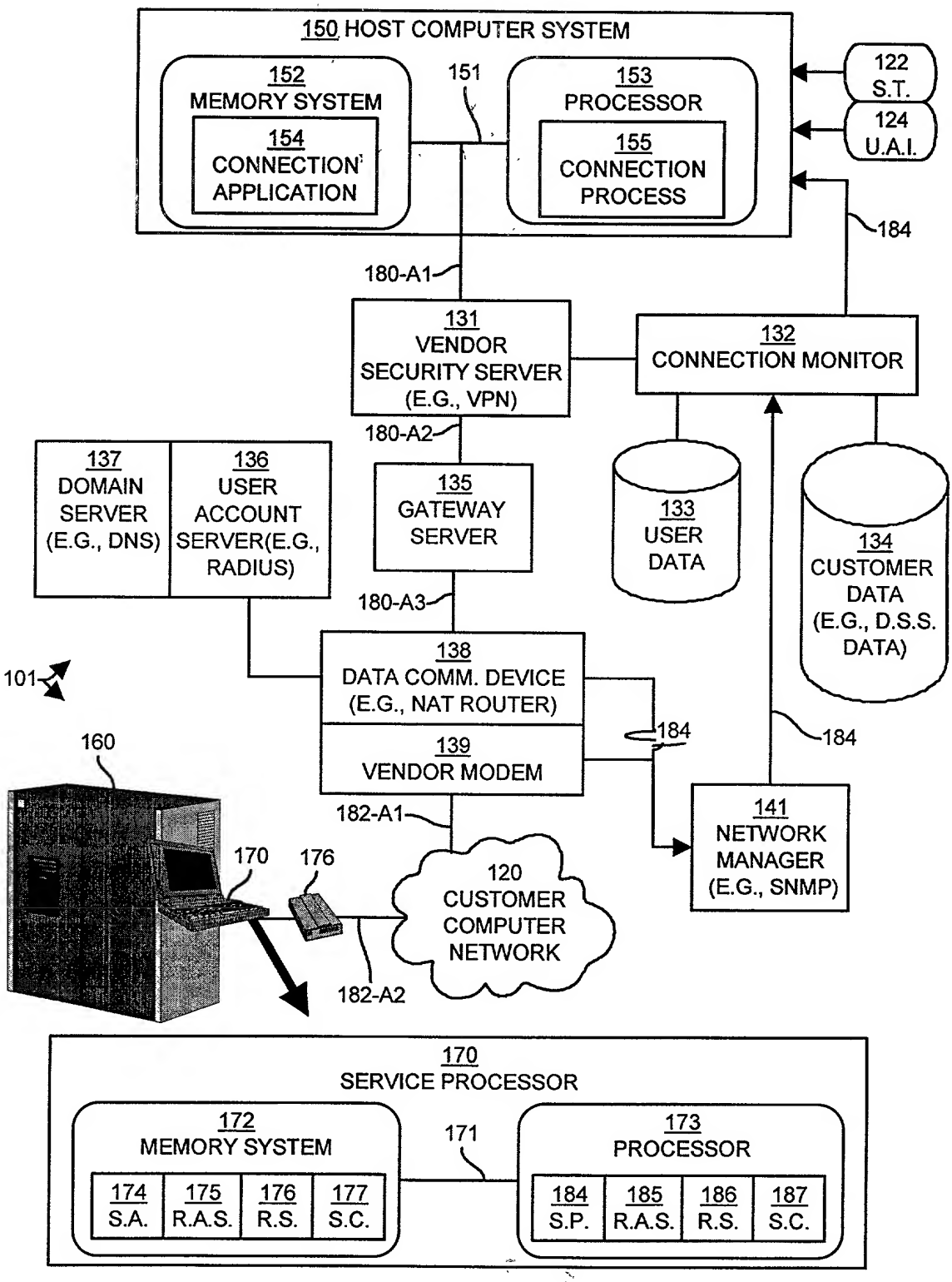
150 HOST COMPUTER SYSTEM
152 MEMORY SYSTEM
154 CONNECTION APPLICATION
151
153 PROCESSOR
155 CONNECTION PROCESS
122 S.T.
124 U.A.I.
184
180-A1
131 VENDOR SECURITY SERVER (E.G., VPN)
132 CONNECTION MONITOR
180-A2
137 DOMAIN SERVER (E.G., DNS)
136 USER ACCOUNT SERVER(E.G., RADIUS)
135 GATEWAY SERVER
133 USER DATA
134 CUSTOMER DATA (E.G., D.S.S. DATA)
180-A3
101
138 DATA COMM. DEVICE (E.G., NAT ROUTER)
139 VENDOR MODEM
184
184
160
182-A1
141 NETWORK MANAGER (E.G., SNMP)
170
176
120 CUSTOMER COMPUTER NETWORK
182-A2
170 SERVICE PROCESSOR
172 MEMORY SYSTEM
174 S.A.
175 R.A.S.
176 R.S.
177 S.C.
171
173 PROCESSOR
184 S.P.
185 R.A.S.
186 R.S.
187 S.C.

FIG. 3

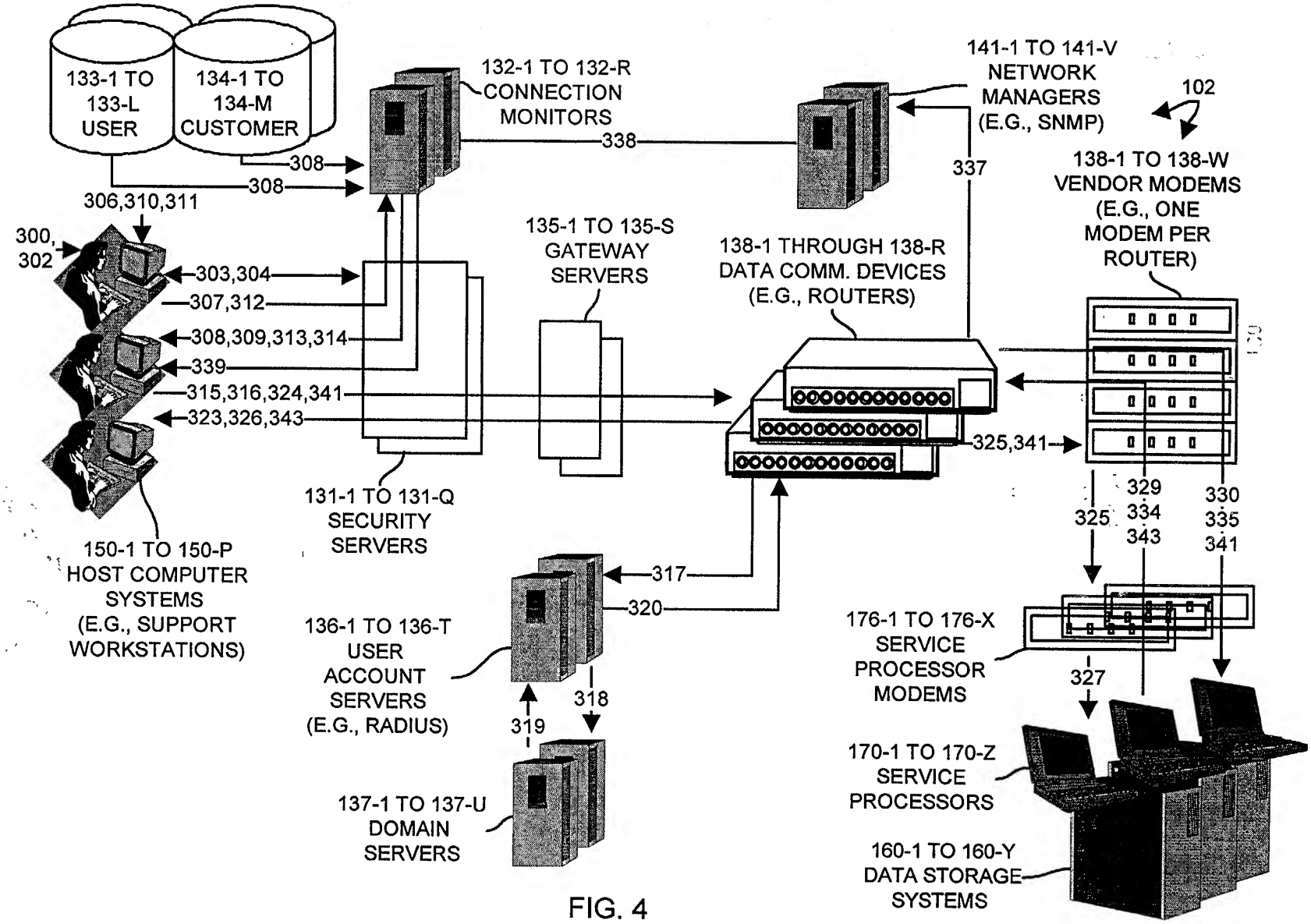
133-1 TO 133-L USER
134-1 TO 134-M CUSTOMER
308
308
306,310,311
132-1 TO 132-R CONNECTION MONITORS
338
141-1 TO 141-V NETWORK MANAGERS (E.G., SNMP)
102
337
138-1 TO 138-W VENDOR MODEMS (E.G., ONE MODEM PER ROUTER)
300, 302
303,304
307,312
308,309,313,314
339
315,316,324,341
323,326,343
135-1 TO 135-S GATEWAY SERVERS
138-1 THROUGH 138-R DATA COMM. DEVICES (E.G., ROUTERS)
325,341
329
334
343
330
335
341
325
131-1 TO 131-Q SECURITY SERVERS
150-1 TO 150-P HOST COMPUTER SYSTEMS (E.G., SUPPORT WORKSTATIONS)
317
320
136-1 TO 136-T USER ACCOUNT SERVERS (E.G., RADIUS)
318
319
176-1 TO 176-X SERVICE PROCESSOR MODEMS
327
170-1 TO 170-Z SERVICE PROCESSORS
137-1 TO 137-U DOMAIN SERVERS
160-1 TO 160-Y DATA STORAGE SYSTEMS

FIG. 4

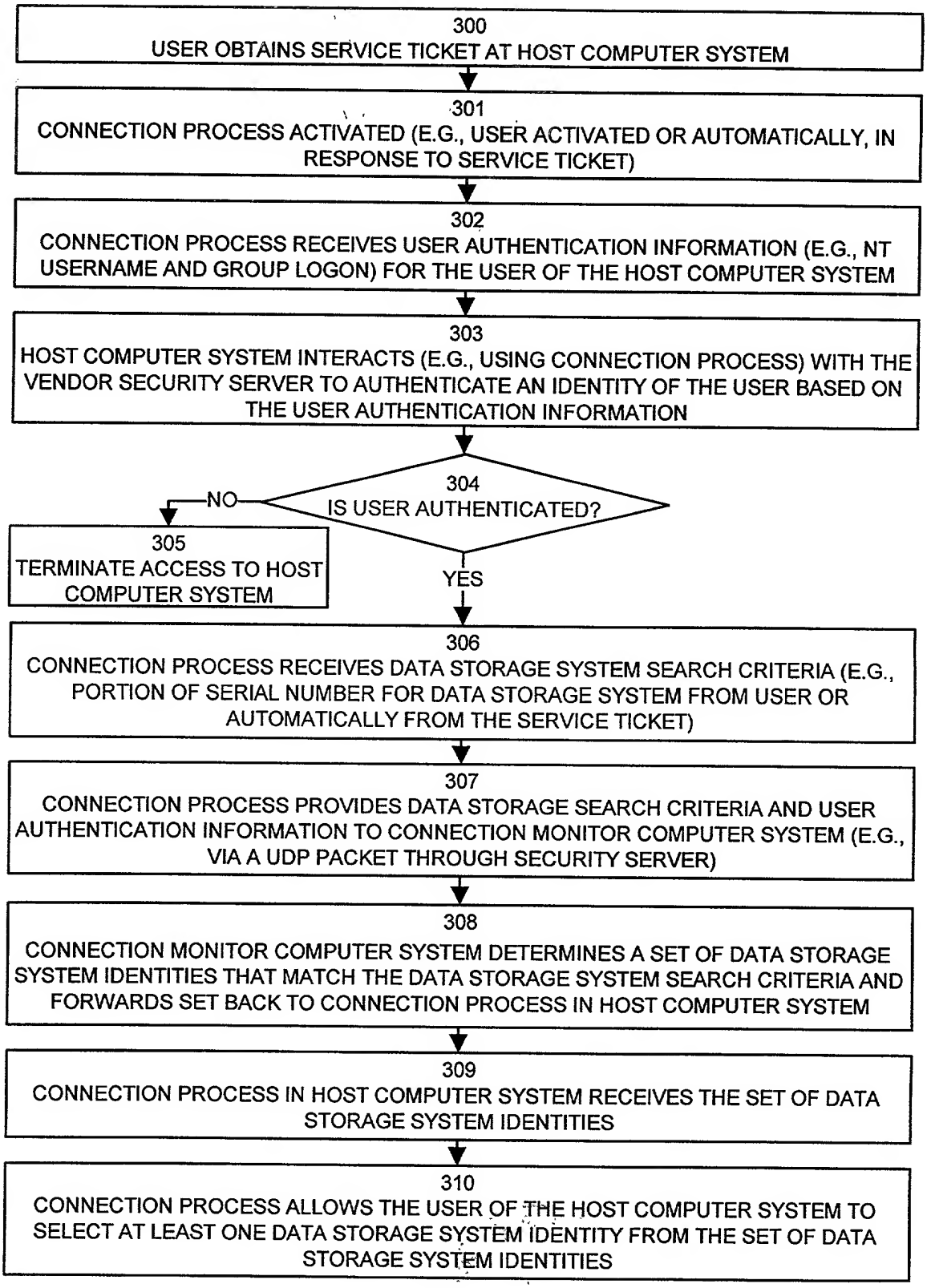
300
USER OBTAINS SERVICE TICKET AT HOST COMPUTER SYSTEM
301
CONNECTION PROCESS ACTIVATED (E.G., USER ACTIVATED OR AUTOMATICALLY, IN RESPONSE TO SERVICE TICKET)
302
CONNECTION PROCESS RECEIVES USER AUTHENTICATION INFORMATION (E.G., NT USERNAME AND GROUP LOGON) FOR THE USER OF THE HOST COMPUTER SYSTEM
303
HOST COMPUTER SYSTEM INTERACTS (E.G., USING CONNECTION PROCESS) WITH THE VENDOR SECURITY SERVER TO AUTHENTICATE AN IDENTITY OF THE USER BASED ON THE USER AUTHENTICATION INFORMATION
304
IS USER AUTHENTICATED?
NO
YES
305
TERMINATE ACCESS TO HOST COMPUTER SYSTEM
306
CONNECTION PROCESS RECEIVES DATA STORAGE SYSTEM SEARCH CRITERIA (E.G., PORTION OF SERIAL NUMBER FOR DATA STORAGE SYSTEM FROM USER OR AUTOMATICALLY FROM THE SERVICE TICKET)
307
CONNECTION PROCESS PROVIDES DATA STORAGE SEARCH CRITERIA AND USER AUTHENTICATION INFORMATION TO CONNECTION MONITOR COMPUTER SYSTEM (E.G., VIA A UDP PACKET THROUGH SECURITY SERVER)
308
CONNECTION MONITOR COMPUTER SYSTEM DETERMINES A SET OF DATA STORAGE SYSTEM IDENTITIES THAT MATCH THE DATA STORAGE SYSTEM SEARCH CRITERIA AND FORWARDS SET BACK TO CONNECTION PROCESS IN HOST COMPUTER SYSTEM
309
CONNECTION PROCESS IN HOST COMPUTER SYSTEM RECEIVES THE SET OF DATA STORAGE SYSTEM IDENTITIES
310
CONNECTION PROCESS ALLOWS THE USER OF THE HOST COMPUTER SYSTEM TO SELECT AT LEAST ONE DATA STORAGE SYSTEM IDENTITY FROM THE SET OF DATA STORAGE SYSTEM IDENTITIES

FIG. 5

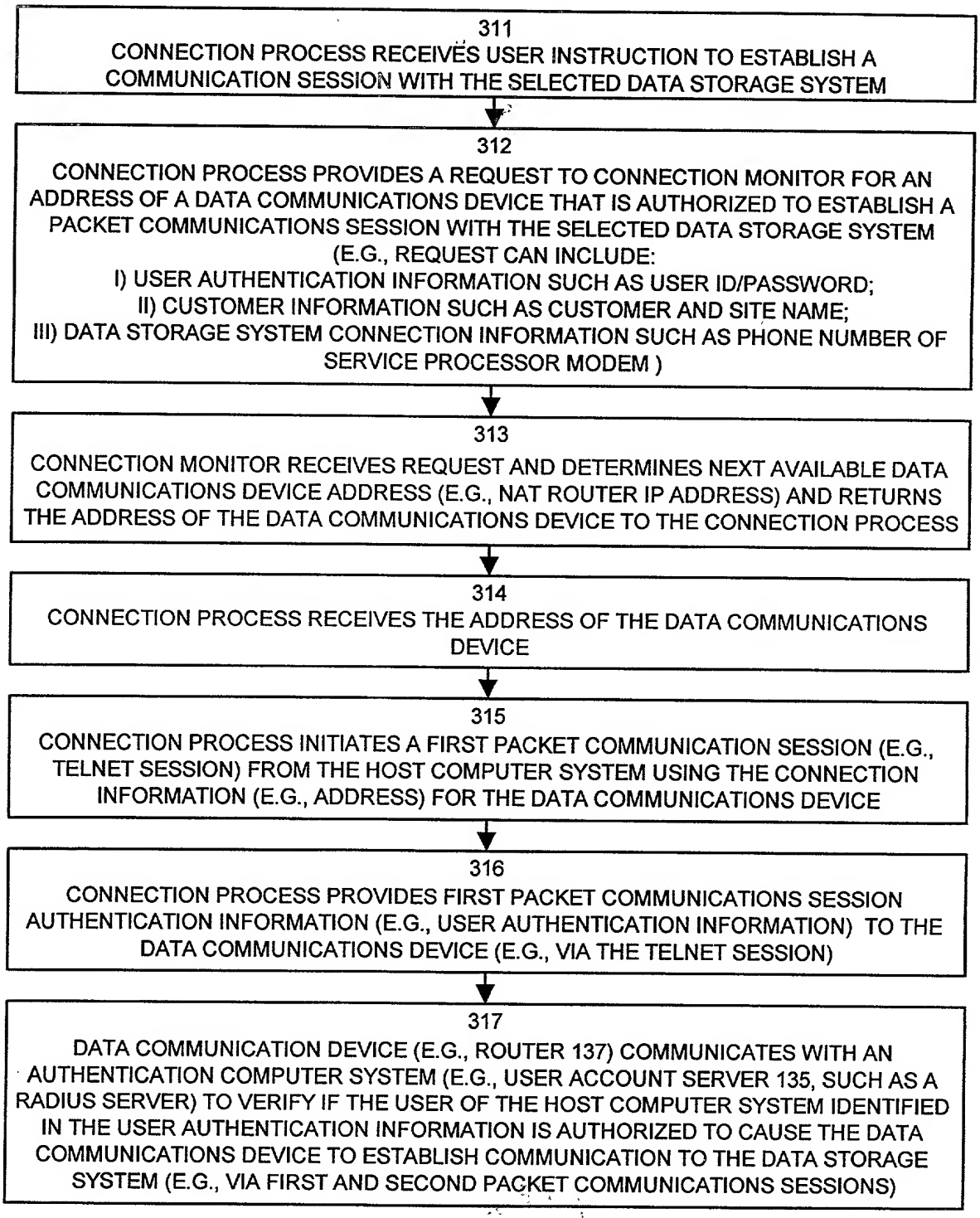
311
CONNECTION PROCESS RECEIVES USER INSTRUCTION TO ESTABLISH A COMMUNICATION SESSION WITH THE SELECTED DATA STORAGE SYSTEM
312
CONNECTION PROCESS PROVIDES A REQUEST TO CONNECTION MONITOR FOR AN ADDRESS OF A DATA COMMUNICATIONS DEVICE THAT IS AUTHORIZED TO ESTABLISH A PACKET COMMUNICATIONS SESSION WITH THE SELECTED DATA STORAGE SYSTEM (E.G., REQUEST CAN INCLUDE:
I) USER AUTHENTICATION INFORMATION SUCH AS USER ID/PASSWORD;
II) CUSTOMER INFORMATION SUCH AS CUSTOMER AND SITE NAME;
III) DATA STORAGE SYSTEM CONNECTION INFORMATION SUCH AS PHONE NUMBER OF SERVICE PROCESSOR MODEM)
313
CONNECTION MONITOR RECEIVES REQUEST AND DETERMINES NEXT AVAILABLE DATA COMMUNICATIONS DEVICE ADDRESS (E.G., NAT ROUTER IP ADDRESS) AND RETURNS THE ADDRESS OF THE DATA COMMUNICATIONS DEVICE TO THE CONNECTION PROCESS
314
CONNECTION PROCESS RECEIVES THE ADDRESS OF THE DATA COMMUNICATIONS DEVICE
315
CONNECTION PROCESS INITIATES A FIRST PACKET COMMUNICATION SESSION (E.G., TELNET SESSION) FROM THE HOST COMPUTER SYSTEM USING THE CONNECTION INFORMATION (E.G., ADDRESS) FOR THE DATA COMMUNICATIONS DEVICE
316
CONNECTION PROCESS PROVIDES FIRST PACKET COMMUNICATIONS SESSION AUTHENTICATION INFORMATION (E.G., USER AUTHENTICATION INFORMATION) TO THE DATA COMMUNICATIONS DEVICE (E.G., VIA THE TELNET SESSION)
317
DATA COMMUNICATION DEVICE (E.G., ROUTER 137) COMMUNICATES WITH AN AUTHENTICATION COMPUTER SYSTEM (E.G., USER ACCOUNT SERVER 135, SUCH AS A RADIUS SERVER) TO VERIFY IF THE USER OF THE HOST COMPUTER SYSTEM IDENTIFIED IN THE USER AUTHENTICATION INFORMATION IS AUTHORIZED TO CAUSE THE DATA COMMUNICATIONS DEVICE TO ESTABLISH COMMUNICATION TO THE DATA STORAGE SYSTEM (E.G., VIA FIRST AND SECOND PACKET COMMUNICATIONS SESSIONS)

FIG. 6

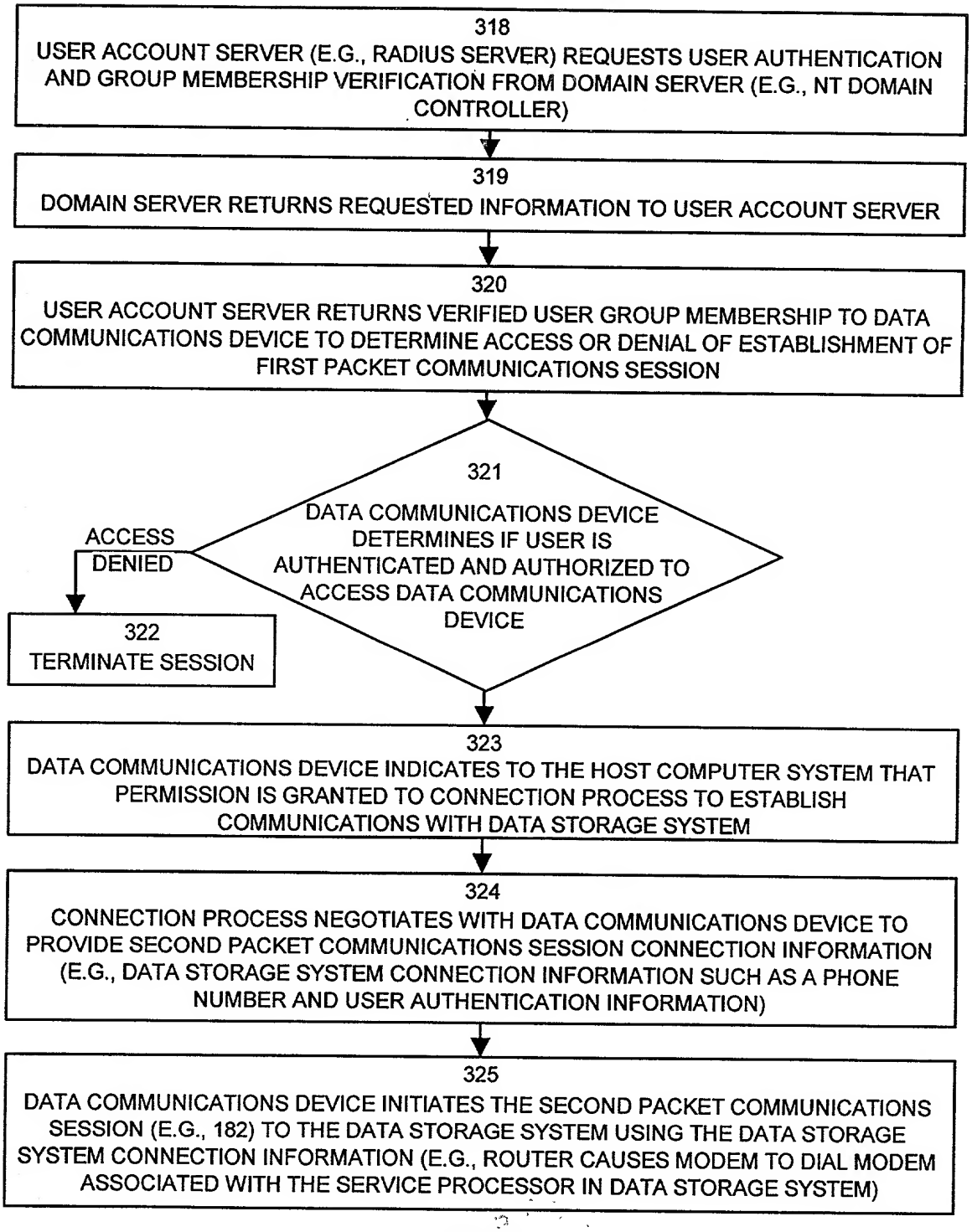
318
USER ACCOUNT SERVER (E.G., RADIUS SERVER) REQUESTS USER AUTHENTICATION AND GROUP MEMBERSHIP VERIFICATION FROM DOMAIN SERVER (E.G., NT DOMAIN CONTROLLER)
319
DOMAIN SERVER RETURNS REQUESTED INFORMATION TO USER ACCOUNT SERVER
320
USER ACCOUNT SERVER RETURNS VERIFIED USER GROUP MEMBERSHIP TO DATA COMMUNICATIONS DEVICE TO DETERMINE ACCESS OR DENIAL OF ESTABLISHMENT OF FIRST PACKET COMMUNICATIONS SESSION
321
DATA COMMUNICATIONS DEVICE DETERMINES IF USER IS AUTHENTICATED AND AUTHORIZED TO ACCESS DATA COMMUNICATIONS DEVICE
ACCESS DENIED
322
TERMINATE SESSION
323
DATA COMMUNICATIONS DEVICE INDICATES TO THE HOST COMPUTER SYSTEM THAT PERMISSION IS GRANTED TO CONNECTION PROCESS TO ESTABLISH COMMUNICATIONS WITH DATA STORAGE SYSTEM
324
CONNECTION PROCESS NEGOTIATES WITH DATA COMMUNICATIONS DEVICE TO PROVIDE SECOND PACKET COMMUNICATIONS SESSION CONNECTION INFORMATION (E.G., DATA STORAGE SYSTEM CONNECTION INFORMATION SUCH AS A PHONE NUMBER AND USER AUTHENTICATION INFORMATION)
325
DATA COMMUNICATIONS DEVICE INITIATES THE SECOND PACKET COMMUNICATIONS SESSION (E.G., 182) TO THE DATA STORAGE SYSTEM USING THE DATA STORAGE SYSTEM CONNECTION INFORMATION (E.G., ROUTER CAUSES MODEM TO DIAL MODEM ASSOCIATED WITH THE SERVICE PROCESSOR IN DATA STORAGE SYSTEM)

FIG. 7

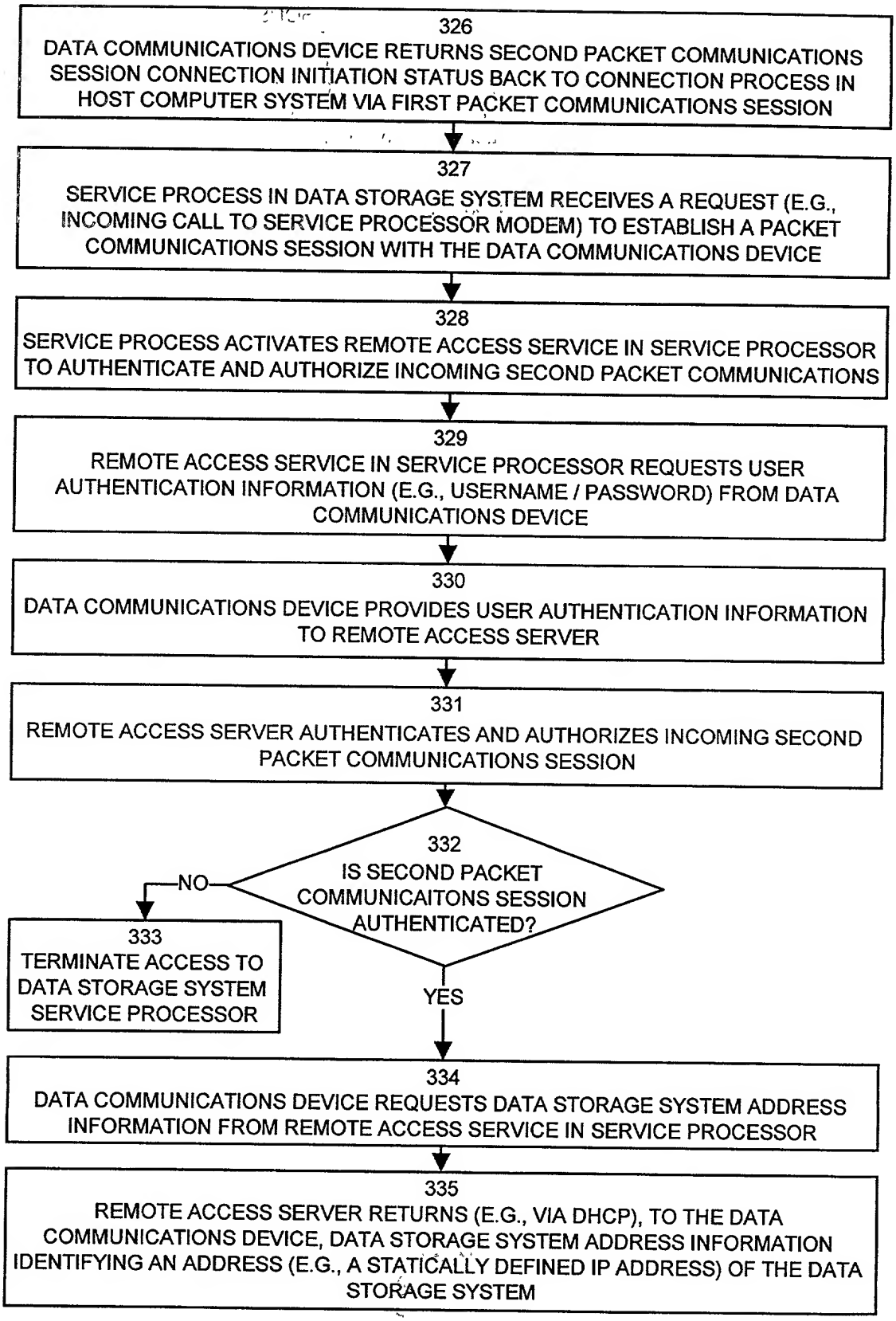
326
DATA COMMUNICATIONS DEVICE RETURNS SECOND PACKET COMMUNICATIONS SESSION CONNECTION INITIATION STATUS BACK TO CONNECTION PROCESS IN HOST COMPUTER SYSTEM VIA FIRST PACKET COMMUNICATIONS SESSION
327
SERVICE PROCESS IN DATA STORAGE SYSTEM RECEIVES A REQUEST (E.G., INCOMING CALL TO SERVICE PROCESSOR MODEM) TO ESTABLISH A PACKET COMMUNICATIONS SESSION WITH THE DATA COMMUNICATIONS DEVICE
328
SERVICE PROCESS ACTIVATES REMOTE ACCESS SERVICE IN SERVICE PROCESSOR TO AUTHENTICATE AND AUTHORIZE INCOMING SECOND PACKET COMMUNICATIONS
329
REMOTE ACCESS SERVICE IN SERVICE PROCESSOR REQUESTS USER AUTHENTICATION INFORMATION (E.G., USERNAME / PASSWORD) FROM DATA COMMUNICATIONS DEVICE
330
DATA COMMUNICATIONS DEVICE PROVIDES USER AUTHENTICATION INFORMATION TO REMOTE ACCESS SERVER
331
REMOTE ACCESS SERVER AUTHENTICATES AND AUTHORIZES INCOMING SECOND PACKET COMMUNICATIONS SESSION
332
IS SECOND PACKET COMMUNICAITONS SESSION AUTHENTICATED?
NO
333
TERMINATE ACCESS TO DATA STORAGE SYSTEM SERVICE PROCESSOR
YES
334
DATA COMMUNICATIONS DEVICE REQUESTS DATA STORAGE SYSTEM ADDRESS INFORMATION FROM REMOTE ACCESS SERVICE IN SERVICE PROCESSOR
335
REMOTE ACCESS SERVER RETURNS (E.G., VIA DHCP), TO THE DATA COMMUNICATIONS DEVICE, DATA STORAGE SYSTEM ADDRESS INFORMATION IDENTIFYING AN ADDRESS (E.G., A STATICALLY DEFINED IP ADDRESS) OF THE DATA STORAGE SYSTEM

FIG. 8

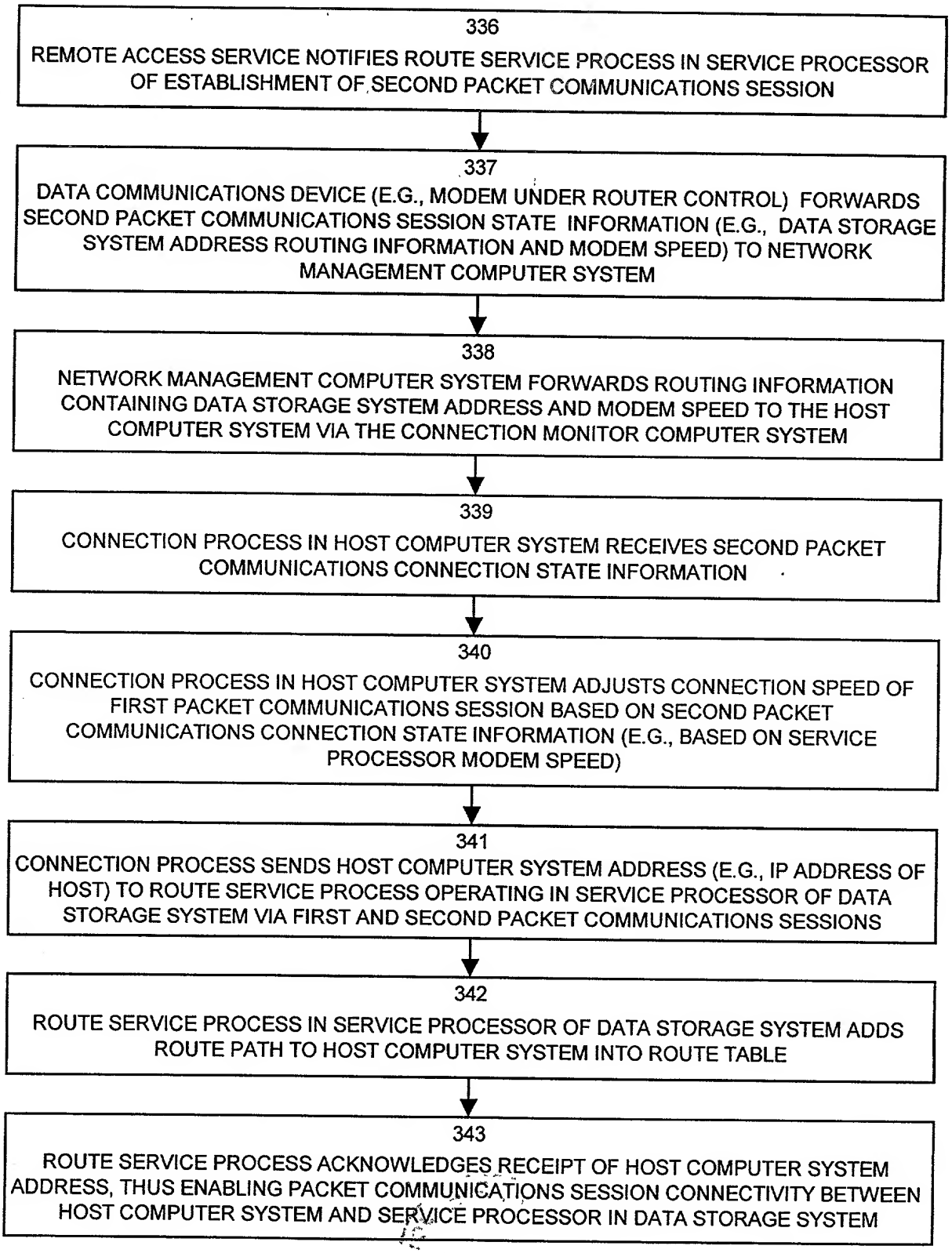
336
REMOTE ACCESS SERVICE NOTIFIES ROUTE SERVICE PROCESS IN SERVICE PROCESSOR OF ESTABLISHMENT OF SECOND PACKET COMMUNICATIONS SESSION
337
DATA COMMUNICATIONS DEVICE (E.G., MODEM UNDER ROUTER CONTROL) FORWARDS SECOND PACKET COMMUNICATIONS SESSION STATE INFORMATION (E.G., DATA STORAGE SYSTEM ADDRESS ROUTING INFORMATION AND MODEM SPEED) TO NETWORK MANAGEMENT COMPUTER SYSTEM
338
NETWORK MANAGEMENT COMPUTER SYSTEM FORWARDS ROUTING INFORMATION CONTAINING DATA STORAGE SYSTEM ADDRESS AND MODEM SPEED TO THE HOST COMPUTER SYSTEM VIA THE CONNECTION MONITOR COMPUTER SYSTEM
339
CONNECTION PROCESS IN HOST COMPUTER SYSTEM RECEIVES SECOND PACKET COMMUNICATIONS CONNECTION STATE INFORMATION
340
CONNECTION PROCESS IN HOST COMPUTER SYSTEM ADJUSTS CONNECTION SPEED OF FIRST PACKET COMMUNICATIONS SESSION BASED ON SECOND PACKET COMMUNICATIONS CONNECTION STATE INFORMATION (E.G., BASED ON SERVICE PROCESSOR MODEM SPEED)
341
CONNECTION PROCESS SENDS HOST COMPUTER SYSTEM ADDRESS (E.G., IP ADDRESS OF HOST) TO ROUTE SERVICE PROCESS OPERATING IN SERVICE PROCESSOR OF DATA STORAGE SYSTEM VIA FIRST AND SECOND PACKET COMMUNICATIONS SESSIONS
342
ROUTE SERVICE PROCESS IN SERVICE PROCESSOR OF DATA STORAGE SYSTEM ADDS ROUTE PATH TO HOST COMPUTER SYSTEM INTO ROUTE TABLE
343
ROUTE SERVICE PROCESS ACKNOWLEDGES RECEIPT OF HOST COMPUTER SYSTEM ADDRESS, THUS ENABLING PACKET COMMUNICATIONS SESSION CONNECTIVITY BETWEEN HOST COMPUTER SYSTEM AND SERVICE PROCESSOR IN DATA STORAGE SYSTEM

FIG. 9